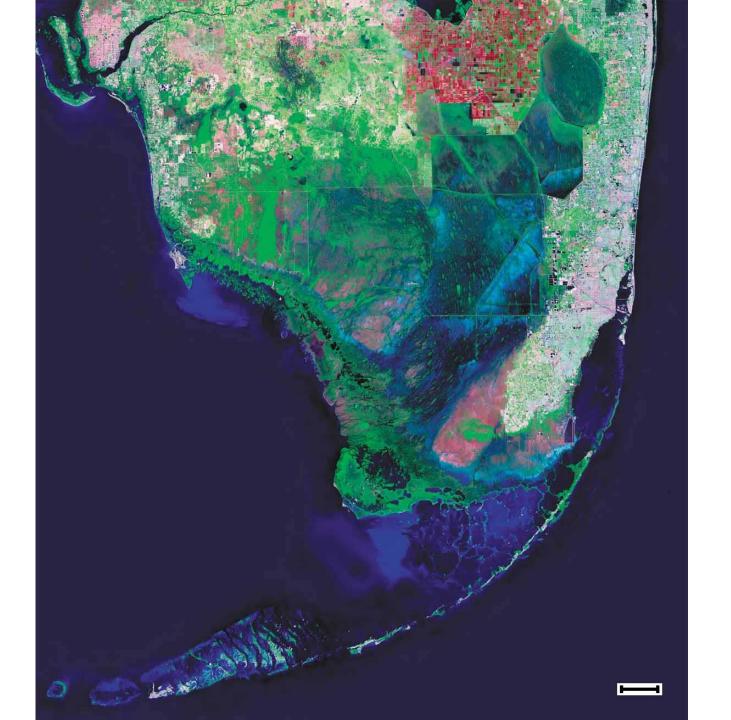
Seagrass dieoff in Florida Bay, causes and consequences... Could the same thing be happening in Biscayne Bay

Jim Fourqurean and Penny Hall







Mass mortality of the tropical seagrass Thalassia testudinum in Florida Bay (USA)

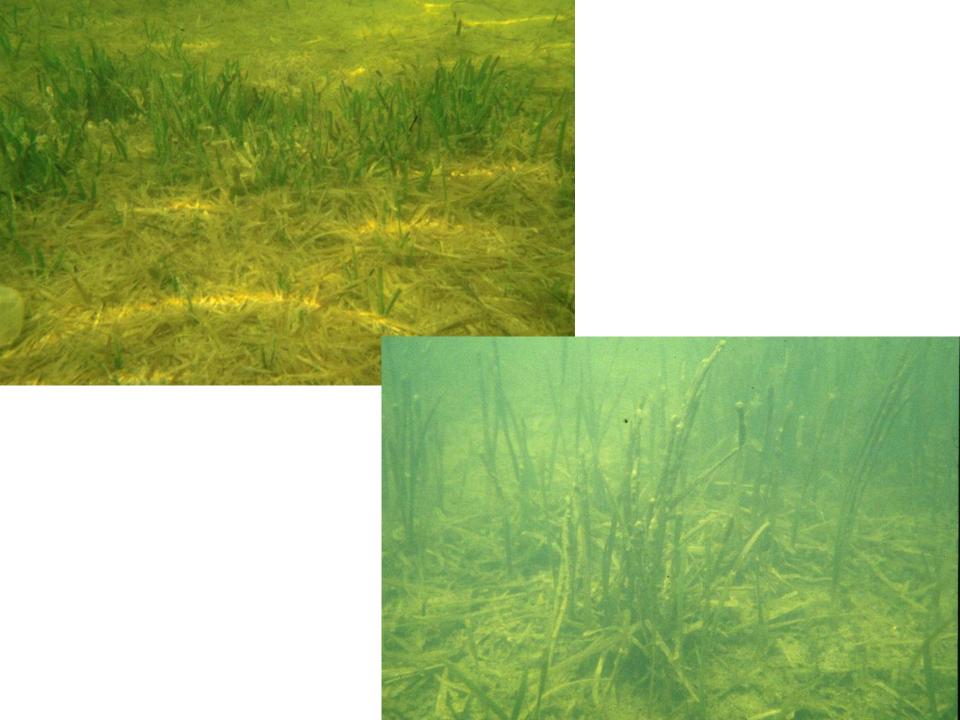
M. B. Robblee¹, T. R. Barber², P. R. Carlson, Jr², M. J. Durako², J. W. Fourqurean³, L. K. Muehlstein⁴, D. Porter⁵, L. A. Yarbro², R. T. Zieman³, J. C. Zieman³

¹ Everglades National Park, South Florida Research Center, Homestead, Florida 33030, USA ² Florida Marine Research Institute, 100 Eighth Avenue SE, St. Petersburg, Florida 33701, USA ³ University of Virginia, Department of Environmental Sciences, Charlottesville, Virginia 22903, USA ⁴ Caribbean Research Institute, University of the Virgin Islands, St. Thomas 00802, U.S. Virgin Islands

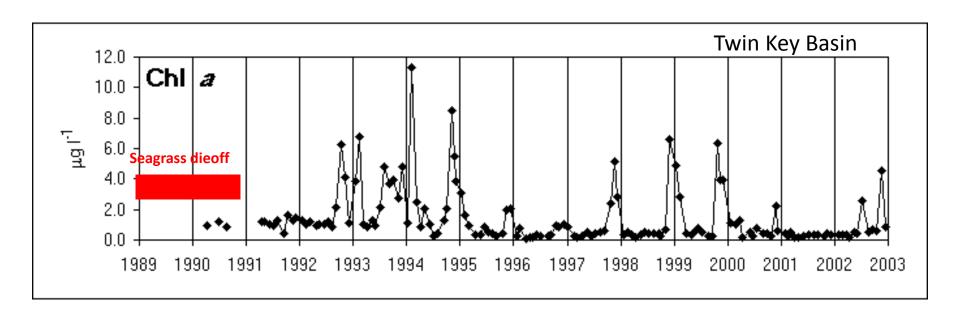






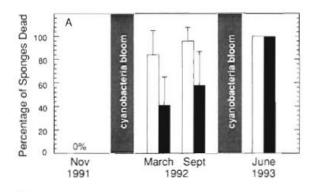


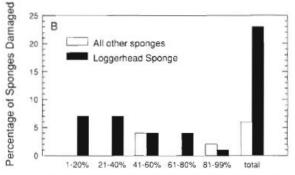
Seagrass dieoffs occurred well before phytoplankton blooms in Florida Bay



Data from FIU water quality monitoring program, and available on the web at http://serc.fiu.edu/wqmnetwork/

Butler et al 1995 MEPS

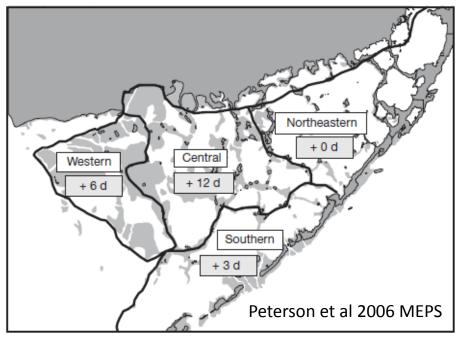


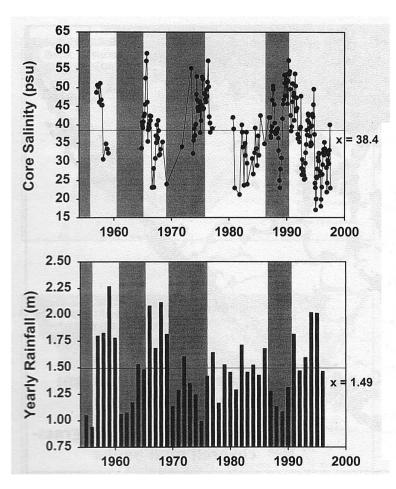


Percentage of Each Individual that was Damaged

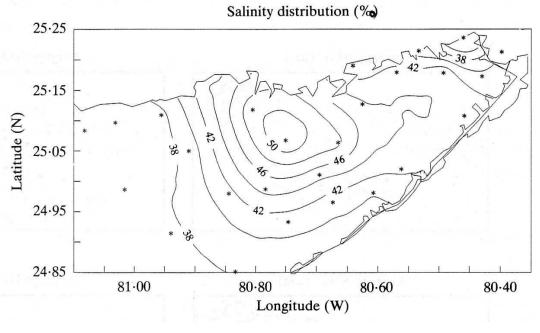








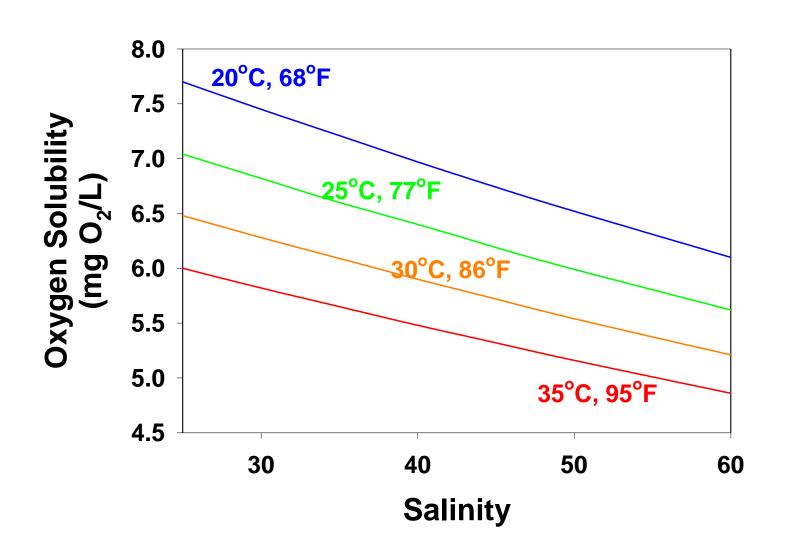
Fourqurean and Robblee 1999 Estuaries



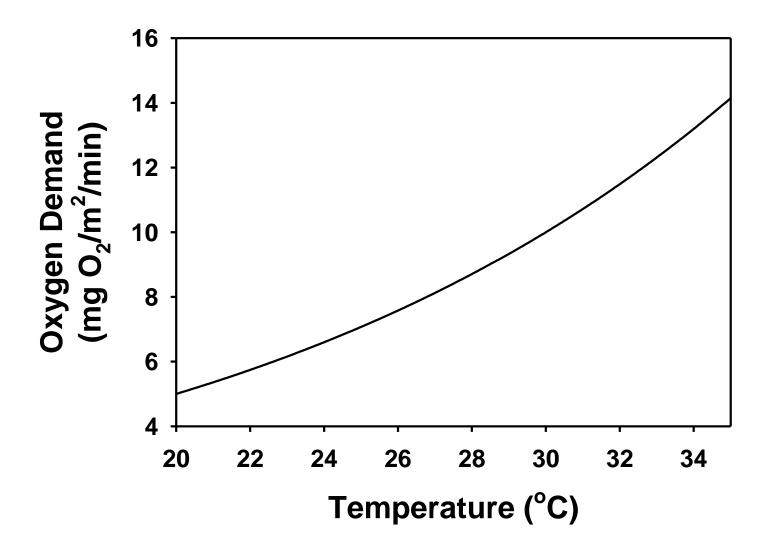
Fourqurean et al 1993 Estuarine Coastal and Shelf Sci

Not a simple relationship with salinity, though....

Hot, salty water can hold less oxygen than cooler less-salty water



Oxygen use increases dramatically with temperature



And dense seagrass meadows use more oxygen that sparse ones

What happens when bacteria run out of oxygen?

They use other chemicals to "burn" their food:

Sugar +
$$O_2$$
 \longleftrightarrow $CO_2 + H_2O$

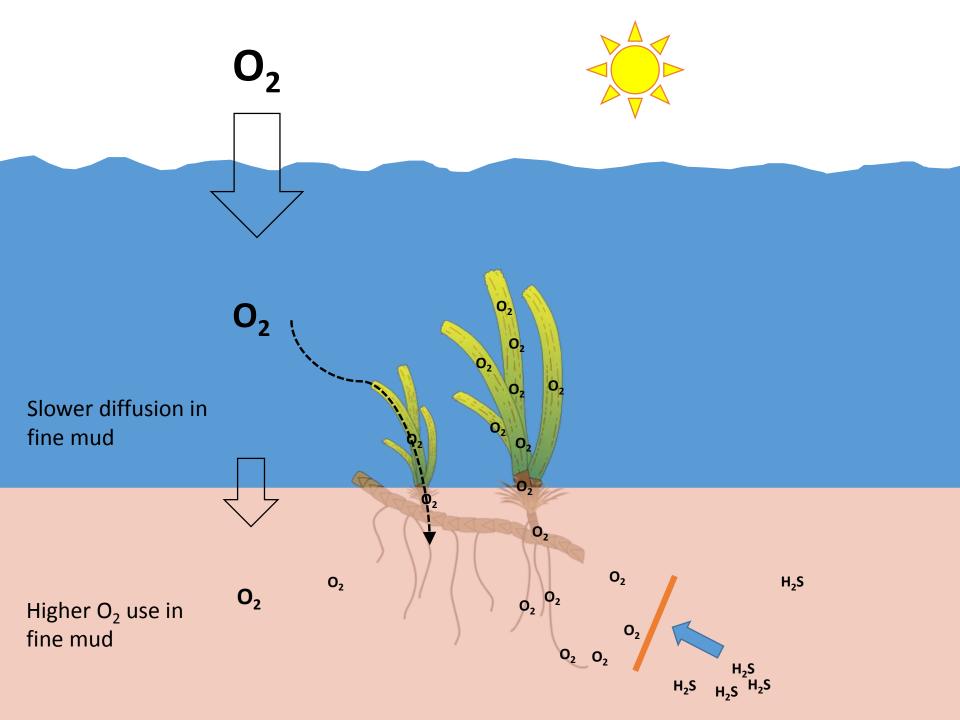
Sugar +
$$NO_3^+$$
 $CO_2 + H_2O + N_2$

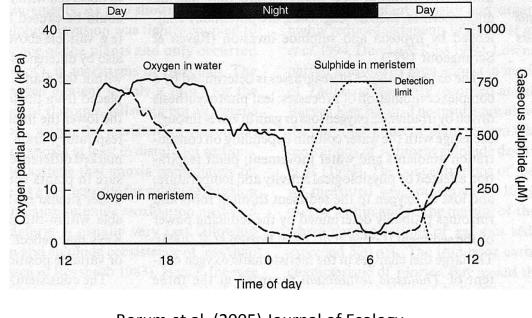
Sugar +
$$SO_4^{2-}$$
 $CO_2 + H_2O + H_2S_4$



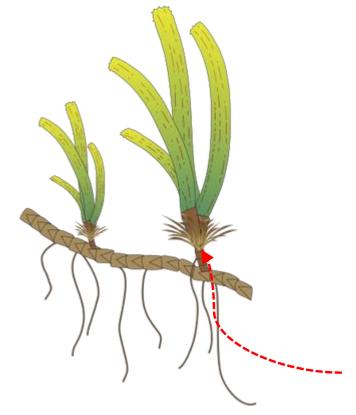
But, Luckily:

$$H_2S + O_2 \longrightarrow S^o + H_2O; S^o + O_2 \longrightarrow SO_4^{2-}$$

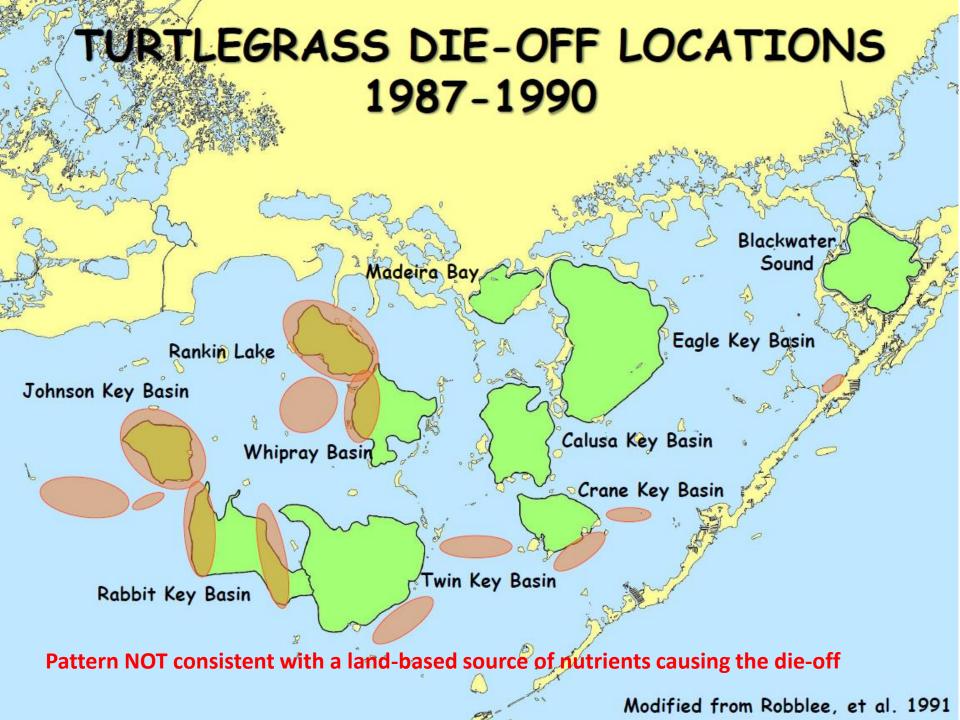


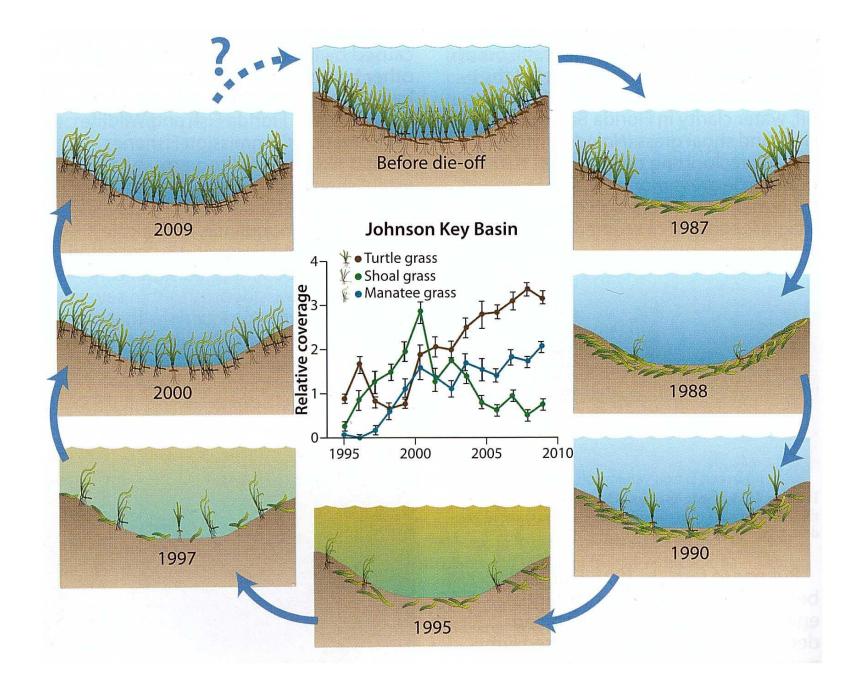


Borum et al. (2005) Journal of Ecology

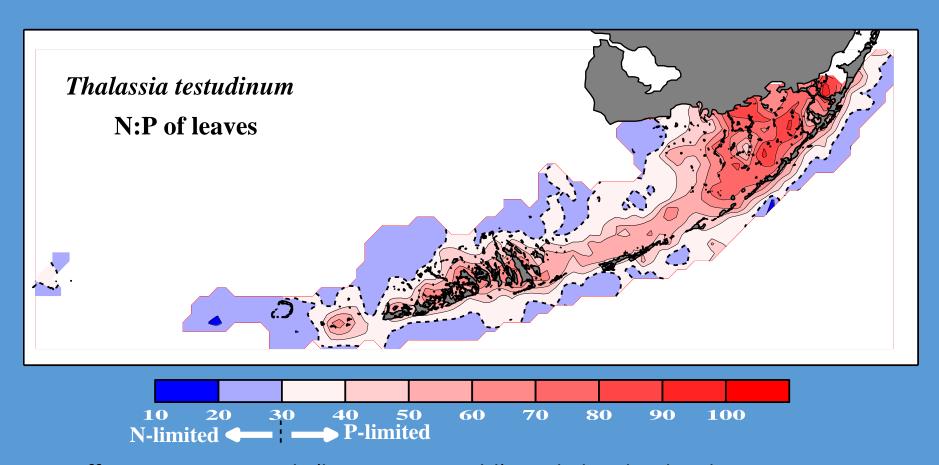


 H_2S



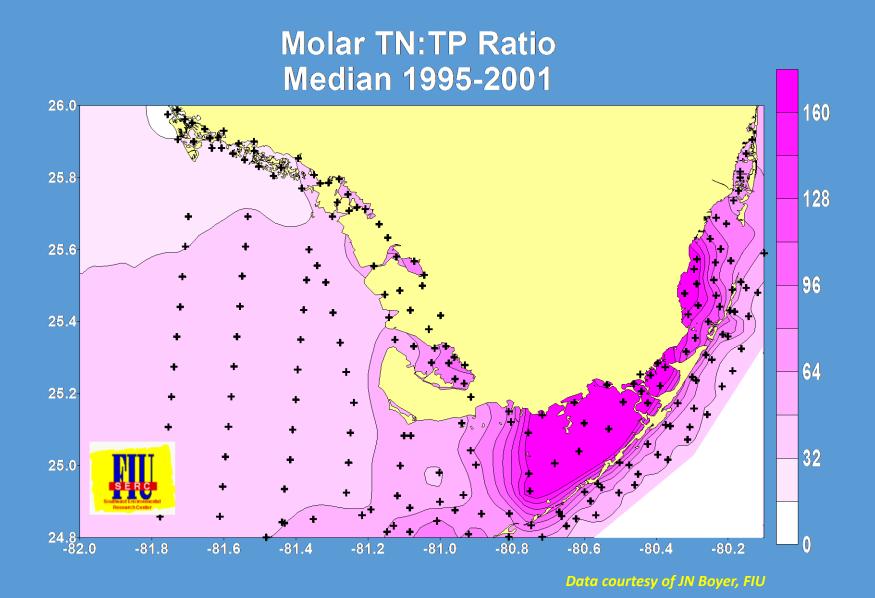


Spatial pattern in nutrient limitation in south Florida



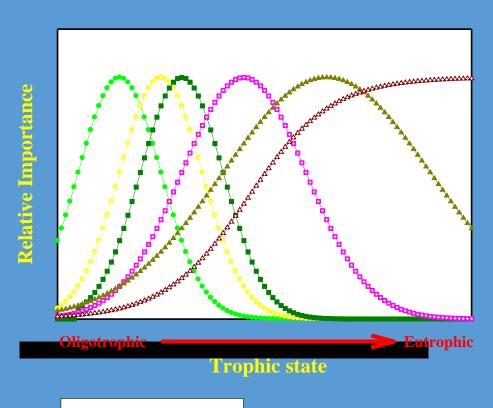
Sufficient nutrient supply (but not too much!) needed to develop dense seagrass meadows that would be susceptible to sulfide toxicity

The water column in Biscayne Bay appears to be P-limited (low nutrients)



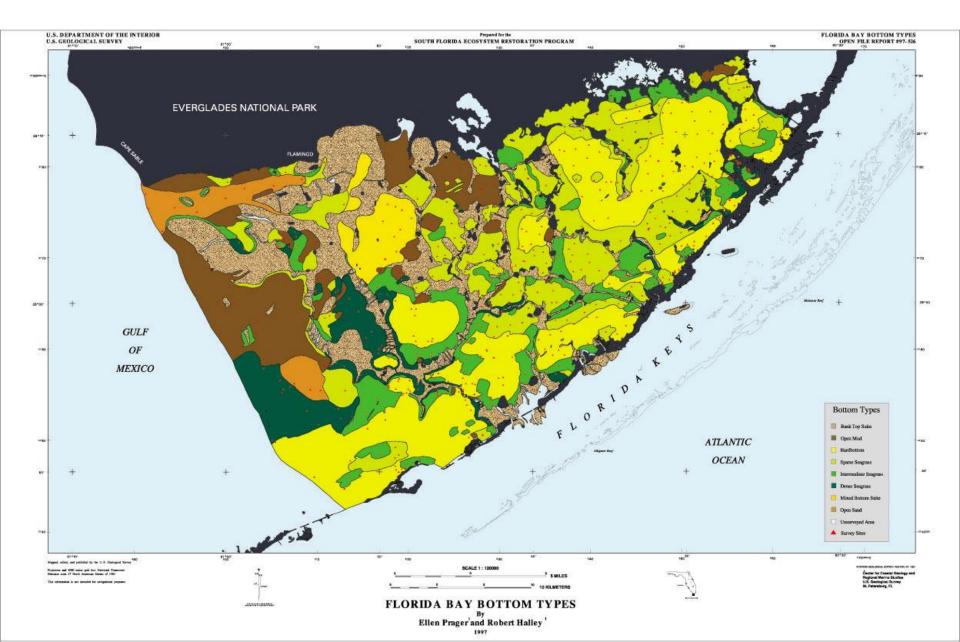
Species composition of seagrass beds is related to nutrient availability

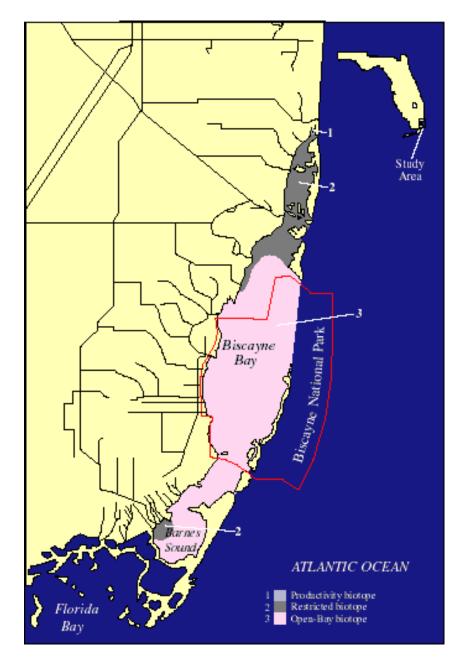
Eutrophication model



- Thalassia testudinum
- Syringodium filiforme
- -- Halodule wrightii
 - Ruppia maritima
- **─** Macroalgae
- → Microalgae

Muddy sediments required for sulfide toxicity





The more enclosed parts of Biscayne Bay are likely to have finer sediments than the more open parts of the bay

Ishman et al 2013, USGS. http://sofia.usgs.gov/publications/posters/pe_record/print.html

